

FORM PTO-1390 (REV. 10-94)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		DOCKET #: 4925-224PUS	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371					
				U.S. APPLICATION NO (if known, see 37 CFR 1.5) <b>107088458</b>	
INTERNATIONAL APPLICATION NO <b>PCT/EP00/09105</b>		INTERNATIONAL FILING DATE <b>14 September 2000</b>		PRIORITY DATE CLAIMED <b>16 September 1999</b>	
TITLE OF INVENTION <b>Transmission Power Control in a Radio Communication System</b>					
APPLICANT(S) FOR DO/EO/US <b>Jaane LAAKSO; Jari SAHINOJA; Harri HOLMA</b>					
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:					
1. <input checked="" type="checkbox"/> This is a <b>FIRST</b> submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a <b>SECOND</b> or <b>SUBSEQUENT</b> submission of items concerning a filing under 35 U.S.C. 371 3. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). 4. <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. 5. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) a. <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). b. <input checked="" type="checkbox"/> has been transmitted by the International Bureau. c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US) 6. <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). 7. <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) a. <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau) b. <input checked="" type="checkbox"/> have been transmitted by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)) 9. <input checked="" type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)) <b>Unexecuted</b> 10. <input type="checkbox"/> A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5))					
<b>Items 11. to 16. Below concern other document(s) or information included:</b>					
11. <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A <b>FIRST</b> preliminary amendment <input type="checkbox"/> A <b>SECOND</b> or <b>SUBSEQUENT</b> preliminary amendment 14. <input type="checkbox"/> A substitute specification 15. <input type="checkbox"/> A change of power of attorney and/or address letter 16. <input checked="" type="checkbox"/> Other items or information ( <i>specify</i> ) PCT Publication Sheet, Int'l Preliminary Report, Int'l Search Report, PCT Request, PCT Demand, Notification of the Recording of a Change, Notice Informing the Applicant of the Communication of the International Application to the Designated Offices					

U.S. APPLICATION NO. (UNKNOWN) SEC. 37 CFR 1.521  
**10/088458**

INTERNATIONAL APPLICATION NO.  
**PCT/EP00/09105**

ATTORNEY'S DOCKET NUMBER  
**4925-224PUS**

17. ☒ The following fees are submitted

**Basic National Fee (37 CFR 1.492(a)(1)-(5)):**

Search Report has been prepared by the EPO or IPO ..... \$890.00  
 International preliminary examination fee paid to USPTO (37 CFR 1.482) ..... \$710.00  
 No international preliminary examination fee paid to USPTO (37 CFR 1.482)  
 but international search fee paid to USPTO (37 CFR 1.445(a)(2)) ..... \$740.00  
 Neither international preliminary examination fee (37 CFR 1.482)  
 nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$1040.00  
 International preliminary examination fee paid to USPTO (37 CFR 1.482)  
 and all claims satisfied provisions of PCT Article 33(2)-(4) ..... \$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT = \$ 890

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months  
 from the earliest claimed priority date (37 CFR 1.492(e)).

Claims	Number Filed	Number Extra	Rate		
Total Claims	36 - 20 =	16	\ \$18.00	\$	288
Independent Claims	3 - 3 =	0	\ \$84.00	\$	
Multiple dependent claim(s) (if applicable)			+ \$280.00	\$	

TOTAL OF ABOVE CALCULATIONS = \$ 1178

Reduction of 1/2 for filing by small entity, if applicable

SUBTOTAL = \$ 1178

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30  
 months from the earliest claimed priority date (37 CFR 1.492(f)) +

TOTAL NATIONAL FEE = \$ 1178

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be  
 accompanied by the appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +

TOTAL FEES ENCLOSED \$1178

Amount to be refunded: \$

charged: \$

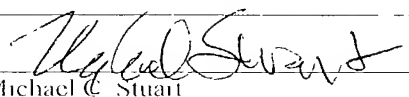
a. ☒ One check in the amount of \$ 1178 to cover the above fee is enclosed

b. ☐ Please charge my Deposit Account No. 03-2412 in the amount of \$ \_\_\_\_\_ to cover the above fees. A duplicate copy of  
 this sheet is enclosed

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any  
 overpayment to Deposit Account No. 03-2412. A duplicate copy of this sheet is enclosed

**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive  
 (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

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By Express Mail # EV072606877US March 15, 2002

Attorney Docket # 4925-224PUS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re National Phase PCT Application of  
Janne LAAKSO et al.  
International Appln. No.: PCT/EP00/09105  
International Filing Date: September 14, 2000  
For: Transmission Power Control in a Radio  
Communication System

**PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231  
BOX PCT

S I R:

Prior to examination of the above-identified application please amend the  
application as follows:

In the Specification:

Page 24, line 1, delete "Claims" and insert therefor --What is claimed is:--.

In the Claims:

Amend claims 3, 4, 6-17, 20, 23-27 and 32 to read as follows:

3. A method according to claim 1, wherein use of a target for the transmission parameter exceeding the limit value is prevented at the controller.

4. A method according to claim 1, wherein the limit value equals with the target for the transmission parameter in use at the moment of detecting the predefined condition.

6. A method according to claim 1, wherein the predefined condition comprises a temporary power limitation situation at the first station.

7. A method according to claim 1, wherein the predefined condition comprises an overload situation at the first station.

8. A method according to claim 1, wherein the predefined condition comprises a failure in the communication system.

9. A method according to claim 1, wherein the monitoring of the occurrence of the predefined condition is based on determination of the interference power of the radio connection.

10. A method according to claim 1, wherein the target for the transmission parameter comprises connection quality target.





By Express Mail # EV072606877US March 15, 2002

second station by providing both the first and the further station with targets for the transmission parameter.

26. A method according to claim 1, wherein connections between the first station and other stations are adjusted in a priority order.

27. A method according to claim 1, wherein the controller comprises a radio network controller of a cellular communication system, the first station comprises a base station of the cellular communication system and the second station comprises a mobile station, and wherein the transmission power to be adjusted comprises transmission power from at least one mobile station towards at least one base station.

32. A communication system according to claim 28, wherein the controller comprises a radio network controller of a cellular communication system, the first station comprises a base station of the cellular communication system and the second station comprises a mobile station, and wherein the transmission power to be adjusted comprises transmission power from at least one mobile station towards at least one base station.

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## REMARKS

This preliminary amendment is presented to place the application in proper form for examination and to eliminate multiple dependency from the present claims. No new matter has been added. Early examination and favorable consideration of the above-identified application is earnestly solicited.

Attached hereto is a mark-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "**Version with markings to show changes made**".

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,  
COHEN, PONTANI, LIEBERMAN & PAVANE

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15 March 2002

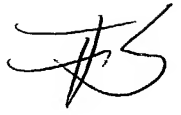


PTO/PCT Rec'd

04 SEP 2002

Attorney Docket # 4925-224PUS

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



In re National Phase PCT Application of

Janne LAAKSO et al.

Serial No.: 10/088,458

Filed: 15 March 2002

For: Transmission Power Control in a Radio  
Communication System

**SECOND PRELIMINARY AMENDMENT**

Assistant Commissioner for Patents  
Washington, D.C. 20231  
**BOX PCT**

S I R:

Prior to examination of the above-identified application please amend the application as follows:

**In the Specification:**

Page 1, before line 3, the title beginning with "Field of the Invention", insert the following title and paragraph:

**--PRIORITY CLAIM**

This is a national stage of PCT application No. PCT/EP00/09105, filed on September 14, 2000. Priority is claimed on that application, and on patent application No. 9921989.1 filed in Great Britain on September 16, 1999.--

By Express Mail # EV110699307US · September4, 2002

**REMARKS**

This preliminary amendment is presented to complete the claim for priority. Early examination and favorable consideration of the above-identified application is earnestly solicited.

Any additional fees or charges required at this time in connection with the application may be charged to our Patent and Trademark Office Deposit Account No. 03-2412.

Respectfully submitted,  
COHEN, PONTANI, LIEBERMAN & PAVANE

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4 September 2002

By Express Mail # EV072606877US March 15, 2002

## AMENDMENTS TO THE SPECIFICATION AND CLAIMS SHOWING CHANGES

In the Claims:

3. A method according to claim 1 [or 2], wherein use of a target for the transmission parameter exceeding the limit value is prevented at the controller.
4. A method according to claim 1 [any of the preceding claims], wherein the limit value equals with the target for the transmission parameter in use at the moment of detecting the predefined condition.
6. A method according to claim 1 [any of the preceding claims], wherein the predefined condition comprises a temporary power limitation situation at the first station.
7. A method according to claim 1 [any of the preceding claims], wherein the predefined condition comprises an overload situation at the first station.
8. A method according to claim 1 [any of the preceding claims], wherein the predefined condition comprises a failure in the communication system.
9. A method according to claim 1 [any of the preceding claims], wherein the monitoring of the occurrence of the predefined condition is based on determination of the interference power of the radio connection.

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10. A method [in] according to claim 1 [any of the preceding claims], wherein the target for the transmission parameter comprises connection quality target.

11. A method according to [any of claims 1 to 9] claim 1, wherein the target for the transmission parameter comprises signalling energy/noise target.

12. A method according to claim 1 [any of claims 1 to 9], wherein the target for the transmission parameter comprises a target transmission power level of the transmission from the second station.

13. A method according to claim 1 [any of the preceding claims], wherein the step of preventing the target for the transmission parameter to exceed the limit value comprises ignoring power control commands at the first station until the predefined condition is over.

14. A method according to claim 1 [any of the preceding claims], wherein the step of preventing of the target for the transmission parameter to exceed the predefined value comprises preventing a generation of new power control commands at the controller until the predefined condition is over.

15. A method according to claim 1 [any of the preceding claims], wherein the controller controls the transmission powers between the first station and the second station by means of outer loop power control.

receiving the target for the transmission parameter from the controller at the first station;

creating a further target for the transmission parameter at the first station for use in the

detecting a difference between the value of the target for the transmission parameter used by the controller and the value of the target for the transmission parameter used for control by the first station after the predefined condition is over; and

20. A method according to claim 17 [any of claims 17 to 19], wherein the difference between the said two target values is reduced gradually.

23. A method according to claim 20 [any of claims 20 or 21], wherein the gradual



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PCT/EP00/09105

TRANSMISSION POWER CONTROL IN A RADIO COMMUNICATION SYSTEM

Field of the Invention

5 The present invention relates to power control in a communication system, and in particular, but not exclusively, to power control of a station of the communication system in a power limitation situation.

10 Background of the Invention

In a mobile telecommunication system, such as CDMA (Code Division Multiple Access) or WCDMA (Wide-band CDMA) or TDMA (Time division Multiple Access) system, transmission power levels between a base (transceiver) station (BS) and a mobile station (MS) associated with said base station can be continuously adjusted during an ongoing connection between the base station and the mobile station. This is done in order to provide a sufficient quality for the transmission in various conditions. To reduce power consumption and interference it is also preferred to keep the required transmission power levels as low as possible at the same time. By means of this it is possible to avoid "wasting" any network resources and power resources, and to enable as great a number of mobile stations as possible to communicate simultaneously with the base station having only limited power resources. The power resources of the base station are limited both in transmission (downlink) and receiving (uplink) directions.

30

In the uplink the limitation means that a base station cannot receive and process more than a predefined number of connections from mobile stations. The uplink direction can be





Ratio) target or any other similar target of the connection is met with a minimal connection quality target. The closed loop power control command is then adjusted at the base station in accordance with the outer loop power control command received from the controller. The connection quality target may sometimes be referred to as a connection setpoint.

The connection quality target or setpoint can be announced e.g. by means of so called Eb/No (Signalling Energy/Noise) target or SIR (Signal to Interference Ratio) target or desired signal level target or a similar parameter indicating a quality measure which can be estimated for the connection. The relationship is such that the connection quality target (e.g. the SIR target) has to be set such that the FER or the BER or similar parameter of the connection remains at an appropriate level. The actual connection quality value (e.g. SIR) is then controlled in accordance with the target value, and one or several of used connection parameters having influence to the quality of the connection should follow any changes in the target value. In most cases it is sufficient if the transmission power is increased/decreased in order to meet the target value. The idea behind the arrangement is that by increasing the connection quality target value the transmission power (or any other appropriate transmission parameter having an influence over the connection quality) will increase and thus the connection quality will increase and the FER will improve.

However, if the appropriate target of the connection quality cannot be met due to e.g. a power limitation situation the connection quality target will start increasing, even though this rise in the connection quality target will not help in causing a better connection between the MS and the BS. The

power limitation condition at the BS can be caused e.g. by an overload situation or a failure. If the power limitation is only temporary the quality target will also be unnecessarily high once this condition has been removed. The temporary

power limitation can occur e.g. when too many mobile stations are trying to become connected to one BS, e.g. when a bus or train with several mobile users suddenly enters the radio coverage area of the base station. The power limitation may also occur e.g. when the radio connection between the BS and one or several mobile stations weakens temporarily, for instance, the MS enters temporarily a tunnel or cellar, which will cause a rapid rise in the transmission powers. The failures causing a power limitation situation may occur in the base station, elsewhere in the communication system or in the mobile stations. The power limitation situation may result in an excessively high power levels within the cell until the quality target has returned to its normal (nominal) level. In addition, an uncontrolled power limitation situation (i.e. the powers of the mobile stations may rise freely) will lead to a situation in which the mobile stations positioned in the edge area of the cell start loose the connection i.e. the mobile stations "drop" from the cell. This leads to a decrease in the size of the cell.

25 Earlier proposals to solve the problems caused by the power  
limitation situation have been based on setting absolute  
limits on the values of the SIR targets. However, the  
absolute limits have to be relatively loose due to the  
variations in the required quality target for satisfactory  
30 quality of the communication. There has not been any  
efficient means for rapidly preventing an excessive increase  
of the target or setpoint value in an overload or other  
sudden power limitation situation. Instead, the target value

has increased further as the target is increased accordingly despite the fact that no more power is available or can be received. In addition, when the power limitation situation is over, the recovery from the increased and unnecessarily high target values may take some time.

#### Summary of the Invention

The embodiments of the present invention aim to address one or several of the above problems.

According to one aspect of the present invention, there is provided a method in a communication system, said system comprising a controller and a first station for communication with a second station with variable transmission power over a radio connection, wherein the controller provides the first station with a target for a transmission parameter of the radio connection and the first station adjusts the transmission power of the second station on basis of the target, comprising: monitoring for a predefined condition; upon occurrence of the predefined condition, preventing use of a target for the transmission parameter exceeding a limit value for the target for the transmission parameter.

According to a more specific embodiment the use of a target for the transmission parameter exceeding the limit value is prevented at the first station. The use of a target for the transmission parameter exceeding the limit value can also be prevented at the controller. The limit value may equal with the target for the transmission parameter in use at the moment of detecting the predefined condition. The predefined condition may comprise a temporary power limitation situation at the first station, an overload situation at the first

30 The communication system may comprise further detecting means for detecting a difference between the target and the further target and recovery means for reducing the difference after the predefined condition is over.

According to a still another aspect of the present invention there is provided a station of a communication system, said station controlling transmission power of a further station  
5 transmitting towards the station, wherein the station is arranged to: receive a target for a transmission parameter provided by a controller of the communications system for use in the control of transmission power of the further station; monitor for a predefined condition; and upon occurrence of  
10 the predefined condition, to prevent use of targets for the transmission parameter exceeding a limit value for the target for the transmission parameter.

The embodiments of the invention provide several advantages.  
15 Should a power limitation situation occur, the embodiments prevent the situation getting even worse by preventing a unnecessary rise of the connection quality target or similar parameter influencing the transmission power in the cell. The powers in the cell may be limited in a level that still can  
20 be handled by the base station. The embodiments may also prevent an increase in the interference in the cell. Since the embodiments enable power resource situation within the cell to remain stable, it is possible to prevent disconnection of the ongoing connections, or to limit the  
25 disconnecting procedures to the connections having a lowest priority. In addition, the embodiments provide a fast response to a power limitation situation without any excessive delays due to e.g. signalling between a base station and a network controller or several controllers. In  
30 addition, the specific embodiments provide a controlled and "smooth" recovery procedure after the power limitation situation has ended.

# Brief Description of Drawings

For better understanding of the present invention, reference will now be made by way of example to the accompanying  
5 drawings in which:

Figure 1 shows schematically a part of a communication system in which the invention can be implemented;

Figure 2 is a block diagram of the base station and the controller of the communication system of Figure 1;

10 Figure 3 illustrates schematically an embodiment of an outer loop power control mechanism in an overload situation;

Figure 4 illustrates schematically a further embodiment of an outer loop power control mechanism in an overload situation;

15 Figure 5 is a table presenting an example of the operation of the present invention at the transceiver of the communication system;

Figure 6 is a table presenting an example of the operation of the present invention at the controller of the  
20 communication system;

Figure 7 is a flowchart illustrating the operation of an embodiment; and

Figure 8 is a flowchart illustrating the operation of a further embodiment.

25

## Description of Preferred Embodiments of the Invention

Figure 1 is a block diagram illustrating a context in which the present invention may be used. That is, a WCDMA system  
30 (Wideband CDMA) mobile communication system allows a plurality of mobile stations MS1, MS2, MS3 to communicate with a base transceiver station (BS) 4 in a common cell over a radio interface via respective channels CH1, CH2, CH3. The

5 and the base station 4 may comprise any kind of data such as speech data, video data or other data. The power control commands between the mobile stations and the base station are handled by a closed loop power control mechanism.

10 The base station 4 is controlled by a controller 5 of the communication system. In the CDMA terminology this controller is often referred to as a radio network controller (RNC). The general arrangement is such that while the base station 4 controls the individual mobile stations 1 - 3 in its radio  
15 coverage area via the radio channels, the network controller 5 functions as a "central" controller controlling several base stations. The mobile stations 1 - 3 can be controlled by the controller 5 through the base station 4.

20 In the currently proposed WCDMA system the base station 4  
receives appropriate control commands from the controller 5  
via an outer loop (OL) power control (PC) mechanism. As  
response to the received commands the base station 4 proceeds  
accordingly to control the connections with individual mobile  
25 stations 1 - 3 via the closed loop (CL) between the  
respective mobile station and the base station. According to  
one possibility the commands may be transmitted in the closed  
loop in the frequency of 1.5 kHz, and in the outer loop in  
the frequency of about 10 to 100 Hz. However, it is noted  
30 that any other frequencies may be used here. The following  
description of the embodiments will concentrate in more  
detail on the outer loop power control (OLPC) mechanism  
between the base transceiver station 4 and the controller 5.



Figure 2 shows in more detail a base station 4 and a radio network controller 5 interacting with each other. The base station 4 of Figure 2 includes a base station control unit (BCU) 6, a transmission power estimation unit (TRX) 7 and a radio channel unit (CHU) 8. The functionalities provided by the respective units as well as the controller 5 are described in the following by using WCDMA terminology. It should, however, be appreciated that the following is only an example of the embodiments and thus the scope of the invention is not restricted by the use of the WCDMA terminology, and that the invention can also be applied to communication systems based on other standards.

The base station 4 of Figure 2 includes a load control (LC) functionality 10 controlling the outer loop power control functionality 12 of the base station (OLPC/BS). The RNC 5 is shown to include a corresponding pair of a load control functionality 11 and an outer loop power control functionality (OLPC/RNC) 13. Communication paths or channels 14 and 15 are provided between the respective LC and OLPC functionalities of the BS 4 and the RNC 5. The RNC is arranged to generate an Eb/No-setpoint 16 which is subsequently transmitted to the BS in a outer loop power control command 15. In the example the command is shown to be in the form of a relative "UP" or "DOWN" command, but the OLPC command from the RNC could also include an absolute value for the targeted Eb/No-setpoint or a relative amount of increase or decrease of the setpoint value.

30

The OLPC/BS at the BS 4 receives the Eb/No-setpoint and may store the setpoint in an appropriate storage functionality. The Eb/No-setpoint which has been received from the RNC 5 is

shown by a functionality 16 of the BS 4. For the purposes of clarity, the setpoint functionality of the base station 4 is designated correspondingly with the setpoint functionality 16 of the RNC 5.

5

In addition to the Eb/No-setpoint 16, the BS 4 of Figure 2 is shown to comprise a second or further Eb/No-setpoint or a BS Eb/No-setpoint functionality 17. The arrangement is such that the second Eb/No-setpoint functionality 17 is used for  
10 controlling the closed loop power control and/or uplink fast load control functionality 18 instead of a direct use of the Eb/No-setpoint 16 received from the RNC. The first Eb/No-setpoint 16 of the BS 4 is always controlled by the RNC 5 and should always have the same setpoint value as the setpoint 16  
15 at the RNC 5. The second Eb/No-setpoint 17 is the setpoint actually provided to the closed loop functionality 18. The arrangement is such that in normal operation the second setpoint 17, i.e. OLPC/BS, follows the first setpoint, i.e. OLPC/RNC functionality 16.

20

When the quality of the bearer between the mobile station(s) in the cell and the base station goes bad enough the outer loop PC functionality 13 in the RNC (OLPC/RNC) 5 starts to increase the Eb/No-setpoints 16 of the radio link  
25 connection(s). An increase of the Eb/No-setpoints will eventually increase the uplink transmission powers from one or several of the mobile stations in the cell correspondingly. Similarly, a decrease of the Eb/No-setpoints would decrease the transmission powers.

30

According to an embodiment of the invention the Load Control (LC) algorithm 10 at the base transceiver station (BS) 4 may start preventive load control actions in order to avoid a



When the total interference value PrxTotal in Figure 2 exceeds PrxTargetBS the OLPC/BS is frozen, and the BS 4 is no longer allowed to transmit closed loop power control commands (CLPCs) towards the MS 1, even though the BS 4 may still receive OLPCs from the RNC 5. According to a more specific embodiment the outer loop PC functionality 18 in the BS (OLPC/BS) is frozen by the BS load control (BS LC) 10 after the PrxTargetBS is exceeded. In practice this means that the OLPC/BS ignores any Eb/No-setpoint increase commands of the OLPC/RNC until the PrxTotal is below the exceeded threshold.

According to a preferred embodiment present in the flow chart of Figure 7, the connection quality target value is not frozen to any precise value in a power limitation situation, but instead the target used for the connection control is prevented to exceed a certain predefined threshold value. In other words, the power control mechanism is not switched off in a power limitation situation. Instead, the connection quality target can be changed and the transmission power levels adjusted in the cell as long as the target does not exceed the temporary set upper limit.

According to one alternative only "DOWN" or "reduce target" type of commands are allowed in the closed loop while any commands aimed to increase uplink transmission powers in the cell will not become transmitted towards the mobile stations.

Figure 2 presents in more detail the use of the PrxTotal measurement. As mentioned above, OLPC/BS is frozen or a temporary upper limit is set when  $\text{PrxTotal} > \text{PrxTargetBS}$ . In the BS the OLPC/BS can be frozen or limited on frame-bases, i.e. the determination of the PrxTotal can be accomplished

over each frame. In this case the total wideband interference power received at the BS would be averaged over one radio frame (e.g. 10ms) in the TRX-unit 7 of the BS 4, and reported periodically (e.g. every 10ms) to the BCU unit 8 of the BS 4.

5 PrxTotal can then be calculated on 10ms.cycles e.g. by using  
sliding average window and an ALPHA-TRIMMED-MEAN filter or  
any other appropriate means for filtering.

The same applies to the OLPC/RNC, but it can be frozen or limited only after a radio resource (RR) indication message 14 is received in the RNC load control 11. The RR indication can be sent e.g. every 0.1s - 1s. The outer loop PC can then be switched on/off based on monitoring of the received PrxTotal.

15 It is to be appreciated that the RNC 5 may alternatively receive some other type indication from the BS 4 instructing the RNC 5 to switch the OLPC/RNC on/off than the PrxTotal indication. It is also noted that the total interference value is only an example of the possible triggering parameter, and other indications of a power limitation situation can also be used for triggering the limitation or freezing procedure of the connection quality setpoint at the base station and/or the controller.

25 As explained, the outer loop PC of the RNC (OLPC/RNC) can be limited or frozen after the overload situation is indicated to the RNC even though this is not always necessary. For instance, the arrangement can be such that the OLPC/RNC does not carry out any Eb/No-setpoint increases, but only replaces "change" type indications with a "no change" type indication. 30 It is also possible to arrange the OLPC/RNC such that only Eb/No-setpoint decreases are allowed. The RNC arrangement may

also be such that a temporary upper limit is set for the Eb/No-setpoint allowing a normal operation of the OLPC/RNC as long as the limit is not exceeded. The limit may equal or be different to that in use in the base station. If the limit is exceeded, use of any excessive setpoint values is prevented at the RNC and thus this embodiment corresponds the use of an upper limit at the BS.

It is also possible to have the outer loop functionality frozen or limited such that all or a selected number of mobile stations communicating with the base station 4 are influenced, i.e. that the power levels of all or selected connections are cut, frozen or held below a certain limit. The connections may also be set into a priority order. In the latter instance the procedure can be such that the power levels of the lowest priority connections are limited and/or frozen first, and the highest priority connections are limited as last, if at all. The priority order classification of the connections may be based on the type of the subscription. A possibility is to use the type of the ongoing connection as basis for the prioritisation. For instance, speech, data and video connections may have different priorities. The same applies for "normal" calls, calls to emergency numbers, business calls, "hotline" calls and so on.

The OLPC/RNC freezing and/or limitation procedure may occur after the interference level or some other indication of a power limitation situation is signalled from the BS to the RNC. As explained, the RR indication message is sent periodically (e.g. in periods between 100ms to 1s). Now, if the interference value PrxTotal exceeds PrxTargetBS (= PrxTarget + PrxOffset) as discussed above, the OLPC/RNC can

After the power limitation situation is over, the operation of the OLPC/BS and OLPC/RNC is returned to a normal mode. The Eb/No-setpoint drifting between the BS and the RNC has to be removed during the recovery after the overload situation is over ( $PrxTotal < PrxTargetBS$ ) and the outer loop PC is again allowed to control the power levels. The base station can remove the drift internally because it knows the actual setpoint value 17 in use at the base station 4 and also the setpoint value 16 in use at the RNC 5. Thus it is possible to set either the setpoint value 16 to equal with the actual setpoint 17 or vice versa before the operation is returned to a normal mode. In addition, history information can be used for the recovery, i.e. the setpoint values in the BS and the RNC can be returned to a value used by them before the power limitation situation was detected. It is also possible to use a default or nominal value to which the setpoint in the RNC

and/or in the BS is returned at the beginning of the normal mode.

5 However, in order to provide a controlled recovery and to avoid any too "sharp" changes in the setpoint values, it may be preferred that the returning to the appropriate setpoint value is not done at once. This is especially the case when the quality of the connection is substantially bad. Therefore it may be preferred to use some procedure to gradually  
10 decrease the drifting.

As shown by the flow chart of figure 8, the BS 4 may initiate the recovery procedure by checking for a possible drift of the Eb/No-setpoints when an Eb/No-setpoint down command is received from the RNC 5. If the check is positive, i.e. an existing drift is detected, the drifting is reduced instead of the actual Eb/No-setpoint. When an Eb/No-setpoint up command is received in BS, then the actual Eb/No-setpoint is always increased if the cell is not overloaded.

20 Before explaining in more detail the embodiments aimed for solving the drifting problem, the arrangements of Figures 3 and 4 will be briefly discussed. It is noted that even though Figures 3 and 4 disclose a more complex communication network  
25 arrangement than Figure 2, the following embodiments can also be implemented in the Figure 2 implementation.

Figure 3 shows a situation in which a mobile station MS is controlled by two separate base stations 4 and 4' (e.g. during a handover procedure). A1 and A2 designate the first setpoints corresponding the setpoint 16 of Figure 2 in the respective base stations. The second setpoint of the base stations is correspondingly designated by B1 and B2. The RNC



5 controls Eb/No-setpoints of the base stations 4 and 4' by providing both base stations with relative outer loop power control (UP/DOWN) over an exemplifying Iub interface 19.

5 Figure 4 shows an embodiment in which the mobile station is subjected to a soft handover procedure. As in the above, the outer loop PC of a radio network controller can control several Eb/No-setpoints in several BSs. However, Figure 4 discloses the possibility that all Eb/No-setpoints in a BS  
10 are not controlled by the same controller. In this kind of situation one of the controllers is the main controller while the other controller is used for assisting in the control of the station during the handover proceedings. In Figure 4 the main controller comprises a serving RNC (S-RNC) 5 and the  
15 assisting controller comprises a drifting RNC (D-RNC) 5'. The serving and drifting RNC are connected to each other over an exemplifying Iur interface 20. Since the overload indication has now to be transmitted from the BS1 to the serving RNC 5 over two interfaces 19 and 20 and also through the drifting  
20 RNC 5', the delay is even longer than what it would be in Figures 2 or 3.

The serving RNC 5 of Figure 4 controls the outer loop PC. However, the load control is performed by the load control 11  
25 of the drifting RNC 5'. This means that in the case of a power limitation situation (overload at BS1 in Figure 4), the outer loop PC functionality performed by the serving RNC is not interrupted, and thus the used Eb/No-setpoint (B1) and Eb/No-setpoint of RNC (A,A1) start to drift. Moreover, the  
30 Eb/No-setpoints (A2,B2) used for other handover branches can also start to increase. However, this does not cause uplink (UL) power increase as long as BS1 can control power of MS in addition to BS2. The reason for this is that the MS will not

increase its transmission power as long as it receives at least one DOWN command from at least one base station.

In a normal situation A1 A2 A and B1 A1 and B2 A2 in Figures 3 and 4. Because of the overload at the BS1 the Eb/No-setpoints have started to drift. The controlling RNC allows the system to return to the normal PC functionality after the radio resource indication measurements have indicated that the PrxTotal is below the set PrxTargetBS. After the cell has returned back on the normal load state ( $\text{PrxTotal} < \text{PrxTargetBS}$ ) the outer loop PC is allowed again to control the power levels at the BS. At this stage a drifting detection unit 21 can define the amount of the drifting.

15 When the normal operation of the power control functionality is allowed again, the drifting of the Eb/No-setpoints has to be reduced. Base station BS1 can remove the drift ( $A1 \neq B1$ ,  $A2 \neq B2$ ) internally, because it knows the actual used value ( $B1, B2$ ) and also the value in use in the RNC ( $A1, A2$ ).

20 However, in order to avoid any too sharp changes in the setpoint values, a gradual Eb/No-setpoint adjustment can be accomplished. This can be done e.g. such that when an Eb/No-setpoint down command is received from the RNC 5, the BS checks drift of Eb/No-setpoints. If the check is positive the

25 drift is reduced instead of the actual Eb/No-setpoint. When an Eb/No-setpoint up command is received in BS, then the actual Eb/No-setpoint is always increased if the cell is not overloaded.

Table 1 of Figure 5 shows various stages of the embodiment for reducing a drift of Eb/No-setpoints between a BS and a RNC when using the following parameters.

SetUp	= 0.5 dB
StepDown	= 0.1 dB
Initial Eb/No-setpoint	= 4.1 dB

5 It is noted that Table 1 shows the operation of an exemplifying power control mechanism using relative adjustments. However, the herein described principles can also be applied to a power control mechanism using absolute adjustment of the power levels.

10

In Table 1 "A" is the Eb/No-setpoint of the RNC. "A1" and "A2" are the outer loop PC Eb/No-setpoint values of BS1 and BS2, respectively. BS1 and BS2 are both controlled by the same RNC. "B1" and "B2" are the Eb/No-setpoints used by the closed loop PC. "B1" and "B2" are controlled by the outer loop PC of the BS. "OFF" means that the outer loop PC functionality is switched off. In other words, when the OLPC is in "OFF" state, the adjustment of "B1" and "B2" is not allowed in base stations regardless the commands transmitted by the OLPC. Correspondingly, adjustment of the "A1" and "A2" values is not allowed in the RNC. When the OLPC is switched "ON", this means that outer loop PC functionality is allowed again.

25 As explained, the OLPC/BS at the base station of the  
overloaded cell is frozen before the OLPC/RNC at the RNC  
becomes frozen and therefore an Eb/No-setpoint drifting may  
exist between the outer loops of the base station 4 and the  
radio network controller 5. Although the drifting can be  
30 eliminated by using the algorithm described above, this may  
not be fast enough procedure in all occasions and some  
further processing may be required.

For instance, the OLPC/RNC might already have been  
 escalated/diverged, i.e. the Eb/No-setpoint of the OLPC/RNC  
 may have raised substantially (several dBs) during the last  
 RR indication period. This is caused partially because the RR  
 5 indication period (i.e. how often the RR indications are  
 sent) may be substantially long, wherein the OLPC/RNC will be  
 frozen a long time (up to one RR indication period) after the  
 OLPC/BS of the overloaded cell was frozen. The freezing of  
 the OLPC/BS may, however, have lead into a generation of  
 10 numerous frame errors (FE). The frame errors will increase  
 the FER. The increased FER will then further unnecessarily  
 increase the Eb/No-setpoint of the OLPC/RNC, and this will  
 increase further the drifting between the OLPC/BS and the  
 OLPC/RNC.

15 The above phenomena is one of the reasons why the normal  
 functionality of the OLPC/RNC may not be enough right after  
 the power limitation situation is over and the limiting or  
 freezing of the OLPC/BS and OLPC/RNC is cancelled. The  
 20 OLPC/RNC Eb/No-setpoint may have been drifted several dBs  
 above the situation the Eb/No-setpoint was during the  
 previous RR indication period just before the power  
 limitation is encountered in the RNC by a new RR indication  
 message from the BS. The OLPC/RNC drift can be defined in the  
 25 following manner:

$$\text{OLPC/RNC DRIFT} = \text{Eb/No}_2 - \text{Eb/No}_1$$

where

30 Eb/No<sub>2</sub> is the Eb/No-setpoint at the point when the  
 overload situation is over and the OLPC/RNC is no longer  
 frozen; and

$E_b/N_{o1}$  is the last  $E_b/N_o$ -setpoint of a RR indication period preceding the RR indication sent from the overloaded BS.

5 The example presented in Table 2 of Figure 6 will clarify further the embodiment. In Table 2  $E_b/N_{o1}$  is the last  $E_b/N_o$ -setpoint of the previous RR indication period preceeding the RR indication sent from the overloaded BS.  $E_b/N_{o2}$  is the  $E_b/N_o$ -setpoint at the point of time when the overload  
10 situation is over and the OLPC/RNC is no longer frozen. "A" is the  $E_b/N_o$ -setpoint of the RNC. "A1" and "A2" are the outer loop PC  $E_b/N_o$ -setpoint values of the BS, which are controlled by the RNC. "B1" and "B2" are the  $E_b/N_o$ -setpoints used by the closed loop PC, and are controlled by the outer loop PC of BS  
15 (OLPC/BS). "OFF" means that the outer loop PC functionality is switched off (i.e. adjusting of "B1" and "B2" is not allowed in the BS or in the case of the RNC, adjusting of "A1" and "A2" values is not allowed. "ON" means that the outer loop PC functionality is allowed to return to normal  
20 operation.

It is possible that the base station and the controller have estimated a different amount of drift to be removed, e.g. due to the different time of initiating the limitation / freezing  
25 procedures. Therefore the algorithm cab be such that after the OLPC/RNC is freed, the drift ( $= E_{bNo2} - E_{bNo1}$ ) will be eliminated by decreasing the OLPC/RNC  $E_b/N_o$ -setpoint e.g. by 0.2 dB (normal decrease may be e.g. 0.1 dB) until the drift equals zero or a new Frame Error occurs. At this stage the  
30 drift elimination algorithm at the RNC is cancelled, the  $E_b/N_o$ -setpoint is increased by e.g. 0.5 dB and a normal OLPC/RNC action will follow. However, the OLPC/BS drifting

prevention algorithm described above may still operate until the drift thereof is removed in its entirety.

It should be appreciated that whilst embodiments of the present invention have been described in relation to mobile stations, embodiments of the present invention are applicable to any other suitable type of user equipment.

The data is described as being in packet form. In alternative  
10 embodiments of the invention the data may be sent in any  
suitable format.

The embodiment of the present invention has been described in the context of a CDMA system. This invention is also  
15 applicable to any other access techniques including frequency division multiple access or time division multiple access as well as any hybrids thereof.

The embodiment of the invention has discussed the interaction  
20 between a radio network controller and a base station.  
Embodiments of the present invention can be applicable to  
other network elements where applicable.

It is also noted herein that while the above describes one  
25 exemplifying embodiment of the invention, there are several  
variations and modifications which may be made to the  
disclosed solution without departing from the scope of the  
present invention as defined in the appended claims.

## Claims

1. A method in a communication system, said system comprising a controller and a first station for communication with a second station with variable transmission power over a radio connection, wherein the controller provides the first station with a target for a transmission parameter of the radio connection and the first station adjusts the transmission power of the second station on basis of the target, comprising:
- monitoring for a predefined condition;
  - upon occurrence of the predefined condition, preventing use of a target for the transmission parameter exceeding a limit value for the target for the transmission parameter.
2. A method according to claim 1, wherein use of a target for the transmission parameter exceeding the limit value is prevented at the first station.
3. A method according to claim 1 or 2, wherein use of a target for the transmission parameter exceeding the limit value is prevented at the controller.
4. A method according to any of the preceding claims, wherein the limit value equals with the target for the transmission parameter in use at the moment of detecting the predefined condition.
5. A method according to claim 4, wherein the target for the transmission parameter is held at the limit value until the condition is over.

6. A method according to any of the preceding claims, wherein the predefined condition comprises a temporary power limitation situation at the first station.

5 7. A method according to any of the preceding claims,  
wherein the predefined condition comprises an overload  
situation at the first station.

8. A method according to any of the preceding claims,  
10 wherein the predefined condition comprises a failure in the  
communication system.

9. A method according to any of the preceding claims,  
wherein the monitoring of the occurrence of the predefined  
15 condition is based on determination of the interference power  
of the radio connection.

10. A method in according to any of the preceding claims,  
wherein the target for the transmission parameter comprises  
20 connection quality target.

11. A method according to any of claims 1 to 9, wherein the target for the transmission parameter comprises signalling energy/noise target.

12. A method according to any of claims 1 to 9, wherein the target for the transmission parameter comprises a target transmission power level of the transmission from the second station.

13. A method according to any of the preceding claims, wherein the step of preventing the target for the transmission parameter to exceed the limit value comprises



ignoring power control commands at the first station until the predefined condition is over.

14. A method according to any of the preceding claims, wherein the step of preventing of the target for the transmission parameter to exceed the predefined value comprises preventing a generation of new power control commands at the controller until the predefined condition is over.

10

15. A method according to any of the preceding claims, wherein the controller controls the transmission powers between the first station and the second station by means of outer loop power control.

15

16. A method in accordance with any of the preceding claims, further comprising steps of:

receiving the target for the transmission parameter from the controller at the first station;

20

creating a further target for the transmission parameter at the first station for use in the transmission power adjustment, wherein the further target corresponds the target received from the controller until the predefined condition is detected whereafter the further target is prevented to exceed the limit value for the target and the target received from the controller is ignored.

25

17. A method in accordance with any of the preceding claims, further comprising steps of:

30

detecting a difference between the value of the target for the transmission parameter provided by the controller and the value of the target for the transmission parameter used



23. A method according to any of claim 20 or 21, wherein the gradual reducing of the difference comprises requesting a decrease of the transmission power by an amount that is greater than the amount of decrease requested in a normal mode of operation until the difference between the target values used by the first station and provided by the controller is below a predefined level.
24. A method according to any of the preceding claims, wherein the transmission power control is based on use of relative power control requests.
25. A method according to any of the preceding claims, wherein the communication system comprises a further station similar to the first station and the controller controls the transmission power of the second station by providing both the first and the further station with targets for the transmission parameter.
26. A method according to any of the preceding claims, wherein connections between the first station and other stations are adjusted in a priority order.
27. A method according to any of the preceding claims, wherein the controller comprises a radio network controller of a cellular communication system, the first station comprises a base station of the cellular communication system and the second station comprises a mobile station, and wherein the transmission power to be adjusted comprises transmission power from at least one mobile station towards at least one base station.
28. A communication system, comprising:

a controller arranged to control transmission power of stations;

a first station and a second station capable of providing a communication path therebetween, wherein the controller is arranged to provide the first station with a target for use in control of the transmission power of the second station;

monitoring means for monitoring for a predefined condition; and

means for preventing use of a target for the transmission parameter exceeding a limit value for the target for the transmission parameter upon occurrence of the predefined condition.

29. A communication system according to claim 28, further comprising at the first station a first target functionality for receiving the target from the controller and a further target functionality for generating a further target for the transmission parameter, wherein the arrangement is such that the further target is used for the power control of the second station and corresponds the target provided by the controller unless the predefined condition is detected whereafter the further target is set such that the limit value for the target for the transmission parameter is not exceeded.

30. A communication system according to claim 29, further comprising detecting means for detecting a difference between the target and the further target and recovery means for reducing the difference after the predefined condition is over.

31. A communication system according to claim 30, wherein the recovery means are arranged to reduce the difference gradually.

5 32. A communication system according to any of claims 28 to  
31, wherein the controller comprises a radio network  
controller of a cellular communication system, the first  
station comprises a base station of the cellular  
communication system and the second station comprises a  
10 mobile station, and wherein the transmission power to be  
adjusted comprises transmission power from at least one  
mobile station towards at least one base station.

33. A station of a communication system, said station  
15 controlling transmission power of a further station  
transmitting towards the station, wherein the station is  
arranged to:

receive a target for a transmission parameter provided by a controller of the communications system for use in the control of transmission power of the further station;

monitor for a predefined condition; and

upon occurrence of the predefined condition, to prevent use of targets for the transmission parameter exceeding a limit value for the target for the transmission parameter.

25

34. A station according to claim 33, further comprising a first target functionality for receiving the target for the transmission parameter provided by the controller and a further target functionality for generating a further target for the transmission parameter, wherein the arrangement is such that the further target is used for the power control of the further station and corresponds the target received from the controller unless the predefined condition is detected

30

whereafter the further target is set by the further target functionality such that the limit value for the target is not exceeded.

5 35. A station according to claim 34, further comprising detecting means for detecting a difference between the target and the further target and recovery means for reducing the difference after the predefined condition is over.

10 36. A station according to claim 35, wherein the recovery means are arranged to reduce the difference gradually.

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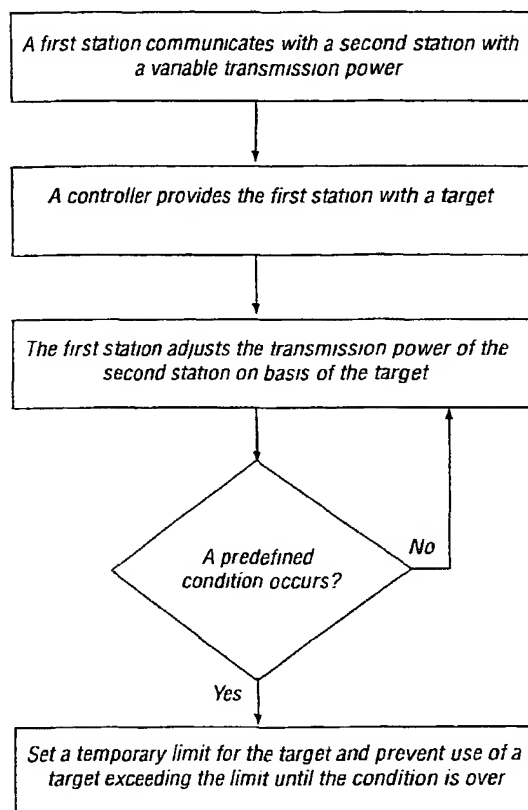
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[Continued on next page]

(54) Title: TRANSMISSION POWER CONTROL IN A RADIO COMMUNICATION SYSTEM



(57) Abstract: The present invention relates to a method in a communication system. The system comprises a controller arranged to control transmission power of stations, a first station and a second station, the controller being arranged to provide the first station with a target for use in control of the transmission power of the second station, monitoring means, and means for preventing use of a target for the transmission parameter that exceeds a limit value. The controller provides the first station with the target and the first station adjusts the transmission power of the second station on basis of the target. A predefined condition is monitored, and upon occurrence of the predefined condition, use of a target for the transmission parameter exceeding a limit value for the target for the transmission parameter is prevented.

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**WFO 01/20806 A1**



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette*

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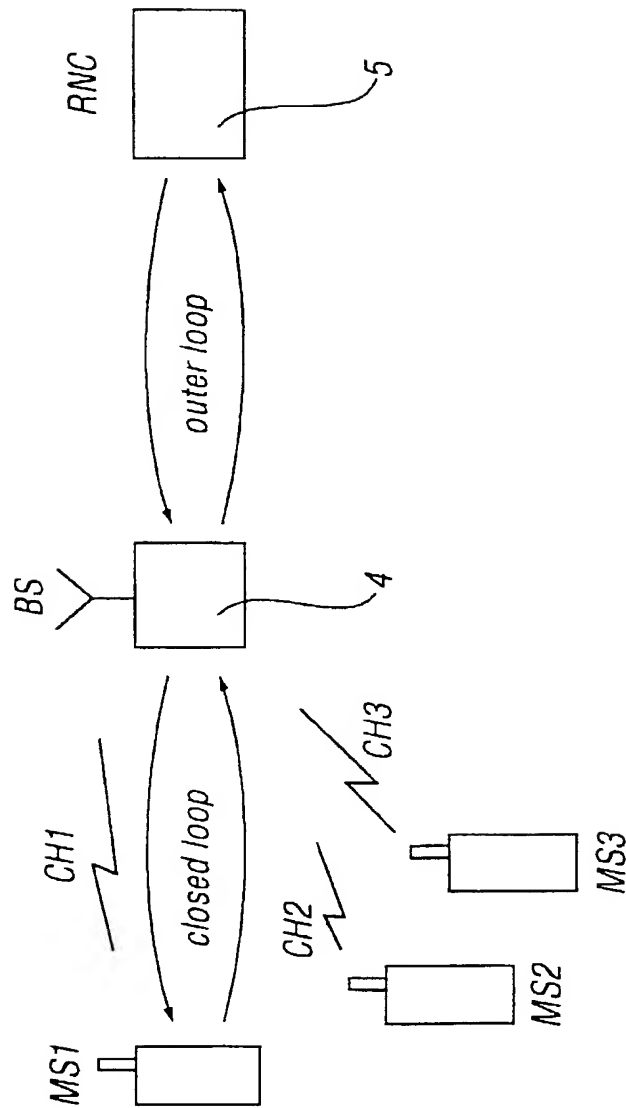


FIG. 1

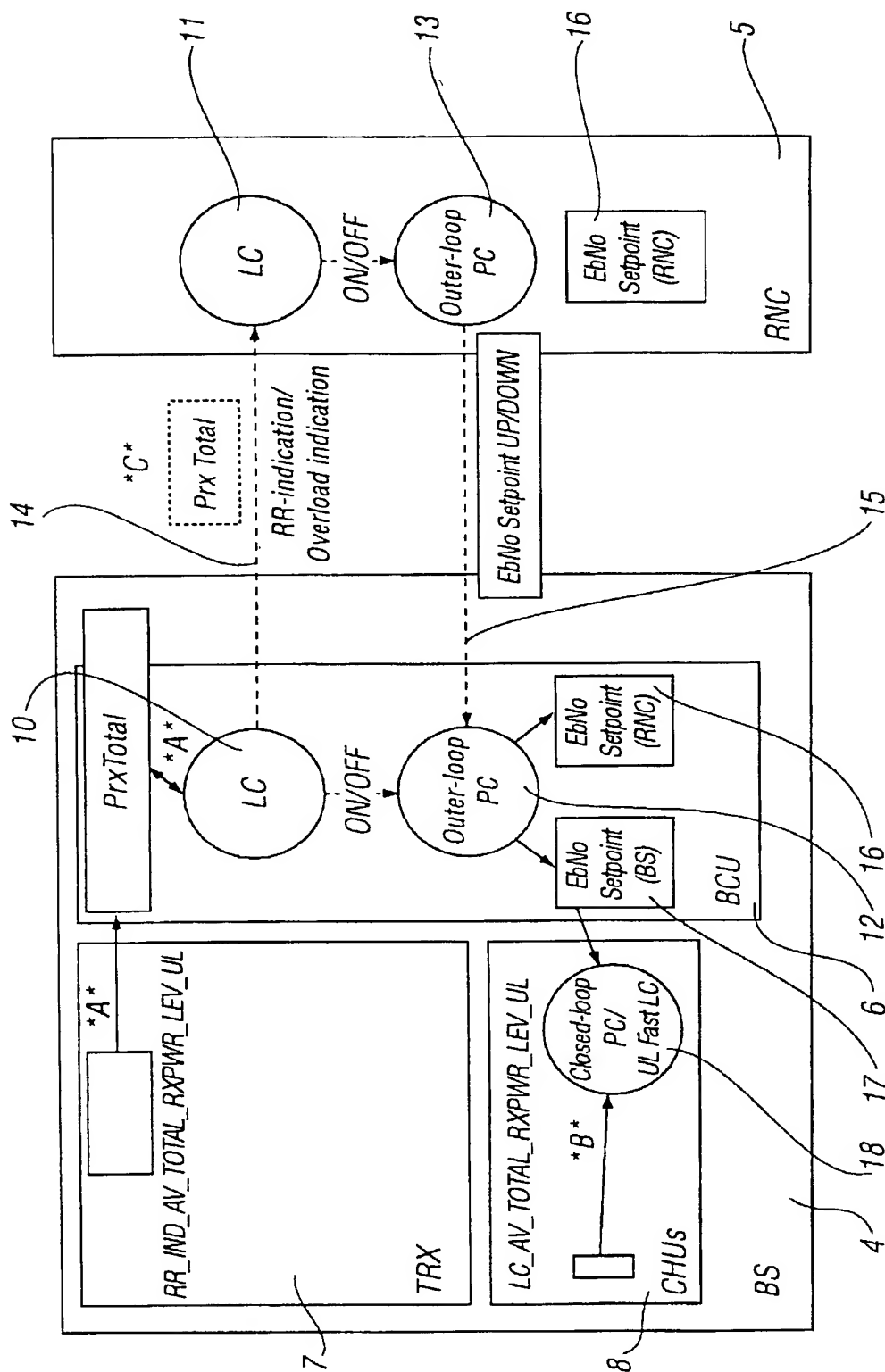


FIG. 2

FIG. 3

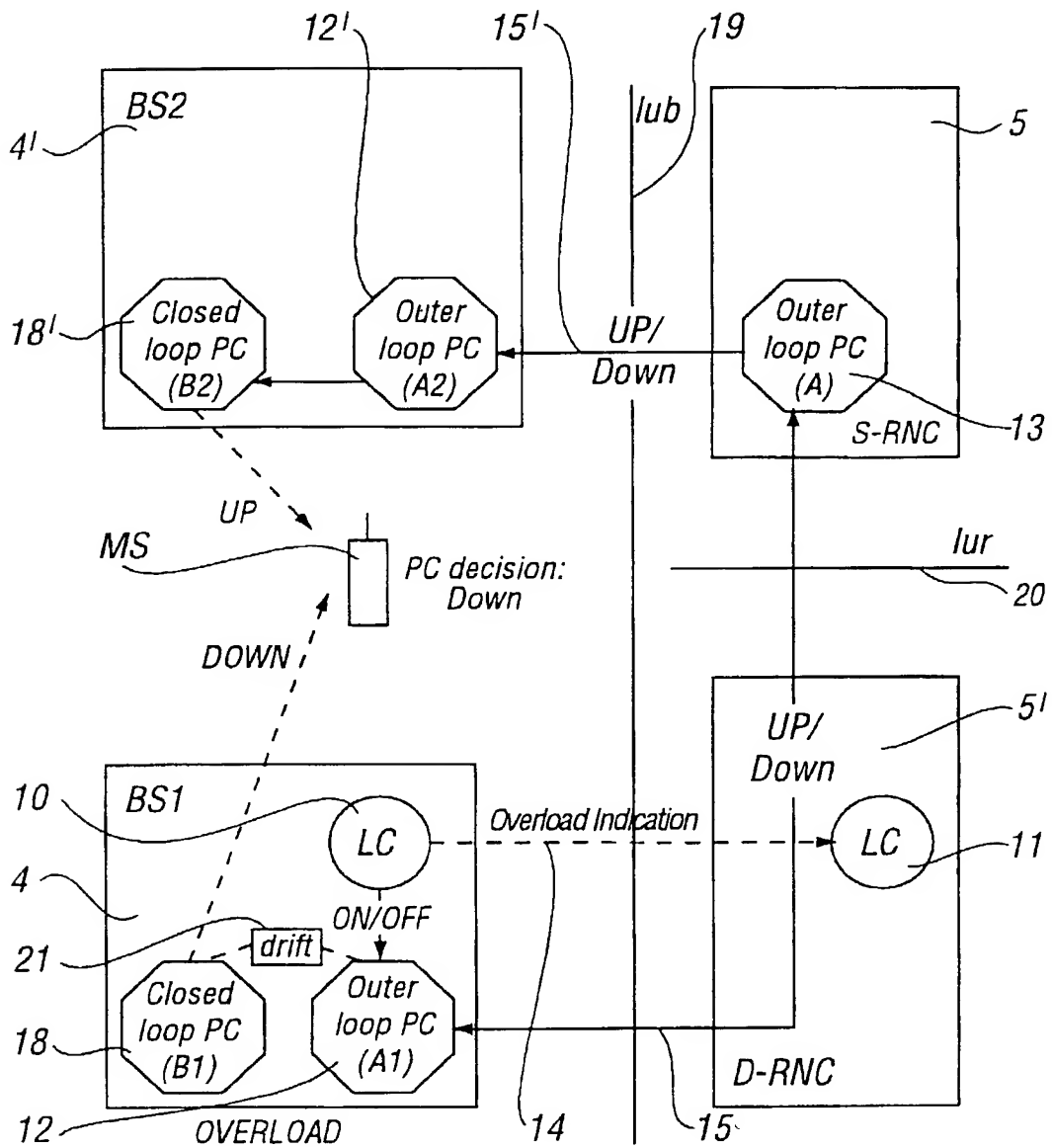


FIG. 4

TABLE 1

RNC A	lub Command	BS1/BS2 A1/A2	BS2 B2	BS1 B1	BS1 DriftB1<>A1
4.1dB		4.1db	4.1db	4.1db	0.0db
Normal functionality					
4.0	StepDown	4.0	4.0	4.0	0.0
4.5	StepUp	4.5	4.5	4.5	0.0
Cell 1 is overloaded, OLPC/BS1 OFF					
5.0	StepUP	5	5	4.5	+0.5
4.9	StepDown	4.9	4.9	4.4	+0.5
Indication to RNC OLPC/RNC OFF					
4.8	Stepdown	4.8	4.3	4.3	+0.5
Cell1 is in normal load, OLPC/BS1 ON					
4.7	StepDown	4.7	4.7	4.3	+0.4
4.6	StepDown	4.6	4.6	4.3	+0.3
4.5	StepDown	4.5	4.5	4.3	+0.2
RNC notices that cell 1 is not overloaded OLPC/RNC ON					
5.0	StepUP	5.0	5.0	4.8	+0.2
4.9	StepDown	4.9	4.9	4.8	+0.1
4.8	StepDown	4.8	4.8	4.8	0.0
4.7	stepDown	4.7	4.7	4.7	0.0

FIG. 5

TABLE 2

RNC A	lub Command	BS1/BS2 A1/A2	BS2 B2	BS1 B1	BS1 DriftB1<>A1
4.1 dB (=EbNo1)		4.1db	4.1db	4.1db	0.0db
Normal functionality					
4.0	StepDown	4.0	4.0	4.0	0.0
4.5	StepUp	4.5	4.5	4.5	0.0
Cell 1 is overloaded, OLPC/BS1 OFF					
5.0	StepUP	5	5	4.5	+0.5
5.5	StepUP	5.5	5.5	4.5	+1.0
Indication to RNC OLPC/RNC OFF					
5.4	Stepdown	5.4	5.4	4.4	+1.0
Cell1 is in normal load, OLPC/BS1 ON					
5.3	StepDown	5.3	5.3	4.4	+1.0
5.2	StepDown	5.2	5.2	4.4	+0.9
5.1 (=EbNo1)	StepDown	5.1	5.1	4.4	+0.8
RNC notices that cell 1 is not overloaded OLPC/RNC ON					
4.9 (-0.2)	StepDown	4.9	4.9	4.4	+0.5
4.7 (-0.2)	StepDown	4.7	4.7	4.4	+0.3
4.5 (-0.2)	StepDown	4.5	4.5	4.4	+0.1
4.3 (-0.2)	StepDown	4.3	4.3	4.3	No drift between BS and RNC EbNo's
4.1 (-0.2) (=EbNo1,the RNC-drift=0)	StepDown	4.1	4.1	4.1	

FIG. 6

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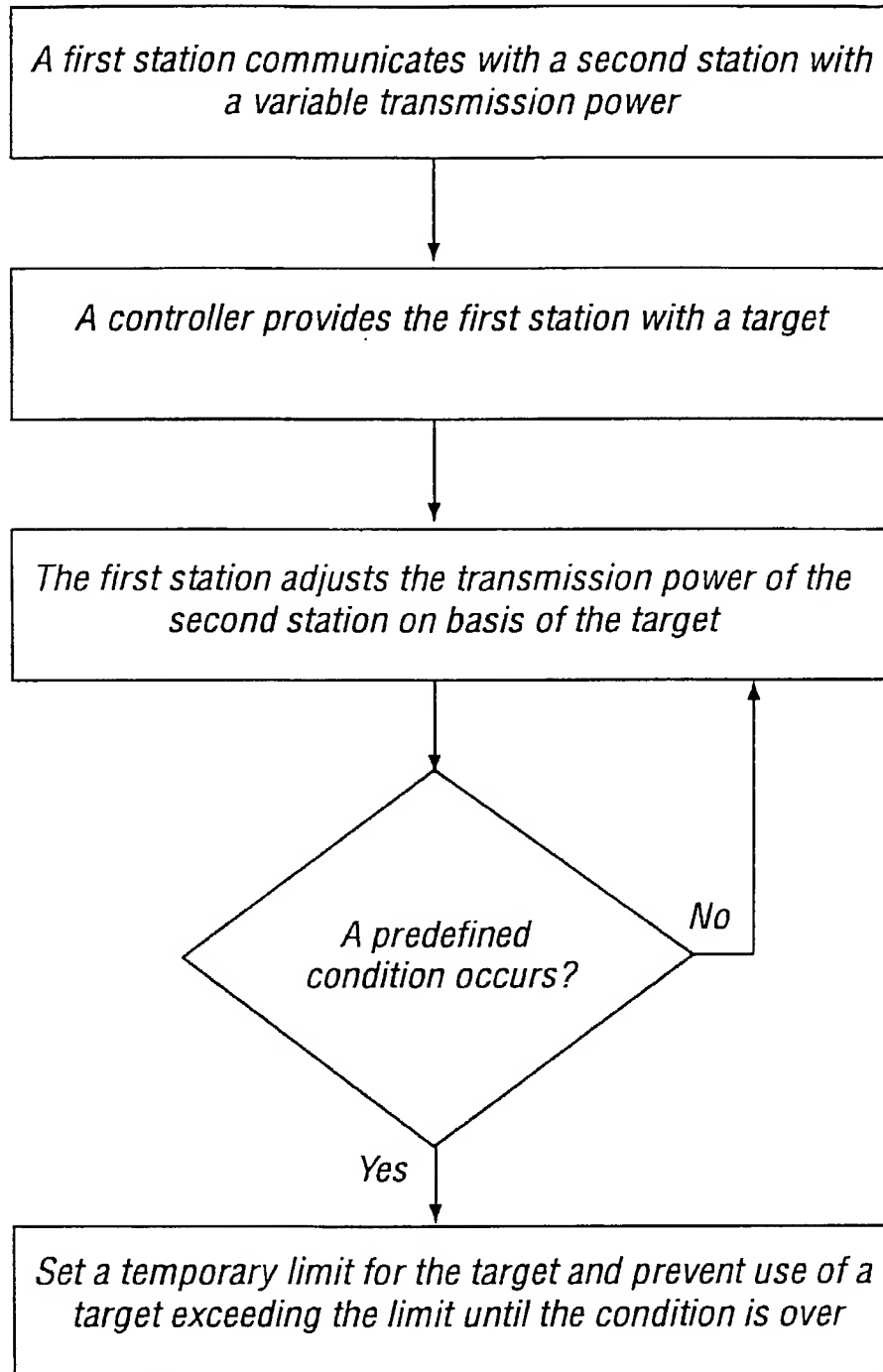


FIG. 7

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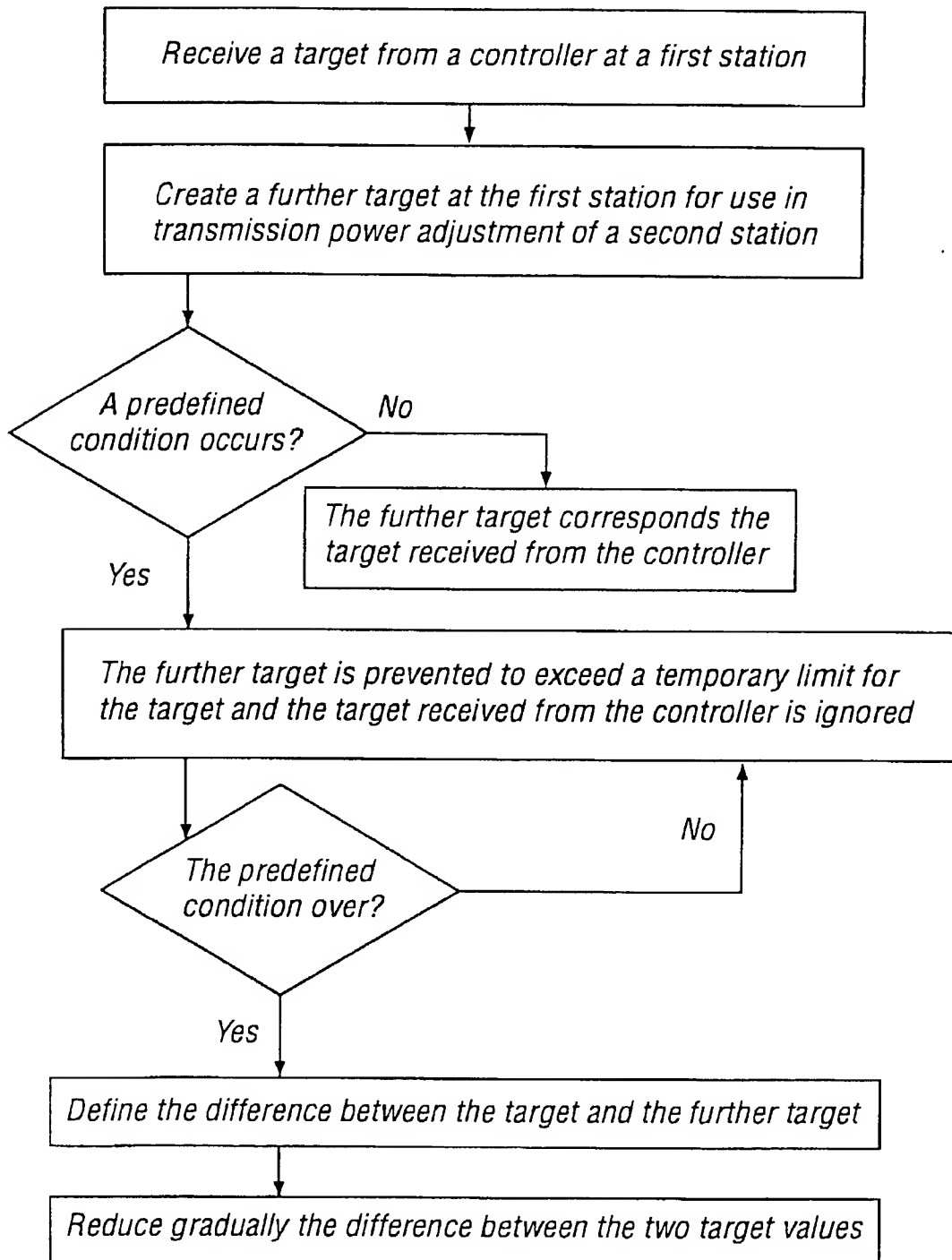


FIG. 8



**COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY**  
 Includes Reference to PCT International Applications

 Attorney's Docket  
 No. 4925-224PUS

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

**TRANSMISSION POWER CONTROL IN A RADIO COMMUNICATION SYSTEM**

the specification of which (check only one item below)

- ☐ is attached hereto  
☐ was filed as United States application  
 Serial No. \_\_\_\_\_  
 on \_\_\_\_\_  
 and was amended  
 on \_\_\_\_\_ (if applicable)  
☒ was filed as PCT international application  
 Number PCT/EP00/09105  
 on 14 September 2000  
 and was amended under PCT Article 19  
 on \_\_\_\_\_ (if applicable).


I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of the application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

**PRIOR FOREIGN/PCT APPLICATIONS AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:**

Country (if PCT, indicate "PCT")	Application Number	Date of Filing (day, month, year)	Priority Claimed Under 35 U.S.C. 119	
Great Britain	9921989.1	16 September 1999	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
PCT	PCT/EP00/09105	14 September 2000	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO
			<input type="checkbox"/> YES	<input type="checkbox"/> NO

Combined Declaration for Patent Application and Power of Attorney (Continued) (Includes Reference to PCT International Applications)				Attorney's Docket No. 4925-224P1S	
I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:					
PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:					
U.S. APPLICATIONS			STATUS (check one)		
U.S. APPLICATION NUMBER	U.S. FILING DATE	PATENTED	PENDING	ABANDONED	
PCT APPLICATIONS DESIGNATING THE U.S.					
PCT APPLICATION NO	PCT FILING DATE	U.S. SERIAL NUMBERS ASSIGNED (if any)			
PCT/EP00/09105	14 September 2000			X	
<b>POWER OF ATTORNEY:</b> As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith (List name and registration number) MYRON COHEN, Reg. No. 17,358; THOMAS C. PONTANI, Reg. No. 29,763; LANCE J. LIEBERMAN, Reg. No. 28,437; MARLIN B. PAVANE, Reg. No. 28,337; MICHAEL C. STUART, Reg. No. 35,698; KLAUS P. STOFFEL, Reg. No. 31,668; EDWARD WEISZ, Reg. No. 37,257; VINCENT M. FAZZARI, Reg. No. 26,879; JULIA S. KIM, Reg. No. 36,567; ALFRED FROEBRICH, Reg. No. 38,887; ALFRED H. HEMINGWAY, JR., Reg. No. 26,736; KENT H. CHENG, Reg. No. 33,849; YUNLING REN, Reg. No. 47,019; ROGER S. THOMPSON, Reg. No. 29,594; BRICE FALLER, Reg. No. 29,532; DAVID J. ROSENBLUM, Reg. No. 37,709; TONY CHEN, Reg. No. 44,607; TEODOR J. HOLMBERG, Reg. No. 50,140.					
Send correspondence to: Michael C. Stuart Reg. No. 35,698 Cohen, Pontani, Lieberman & Pavane 551 Fifth Avenue, Suite 1210 New York, New York 10176			Direct Telephone calls to: (name and telephone number) Michael C. Stuart (212) 687-2770		
 27799 PATENT TRADEMARK OFFICE					
201	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME	
	RESIDENCE, CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP	
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY	
202	FULL NAME OF INVENTOR	FAMILY NAME	FIRST GIVEN NAME	SECOND GIVEN NAME	
	RESIDENCE, CITIZENSHIP	CITY	STATE OR FOREIGN COUNTRY	COUNTRY OF CITIZENSHIP	
	POST OFFICE ADDRESS	POST OFFICE ADDRESS	CITY	STATE & ZIP CODE/COUNTRY	

Combined Declaration for Patent Application and Power of Attorney (Continued) (Includes Reference to PCT International Applications)			Attorney's Docket No. 4925-224PT'S
1 FULL NAME OF INVENTOR	FAMILY NAME HOLMA	FIRST GIVEN NAME Harri	SECOND GIVEN NAME
2 RESIDENCE, CITIZENSHIP	CITY Helsinki	STATE OR FOREIGN COUNTRY Finland	COUNTRY OF CITIZENSHIP Finland
3 POST OFFICE ADDRESS	POST OFFICE ADDRESS Ripusuontie 92 C	CITY Helsinki	STATE & ZIP CODE COUNTRY FIN-00660 Finland
<p>I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.</p>			
SIGNATURE OF INVENTOR 201	SIGNATURE OF INVENTOR 202	SIGNATURE OF INVENTOR 203	
DATE 14 June 2002	DATE 25 June 2002	DATE 16 July 2002	